DOCUMENT RESUME

ED 265 065 SE 046 366

TITLE	Maryland: Mountains to the Sea. A Gallery Class, Grades 4-6.
INSTITUTION	National Aquarium in Baltimore, MD. Dept. of Education.
PUB DATE	83
NOTE	21p.; For related documents, see SE 046 364-367.
AVAILABLE FROM	National Aquarium in Baltimore, Pier 3, 501 E. Pratt St., Baltimore, MD 21202 ($2.00).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Elementary School Science; *Estuaries; Exhibits; Field Trips; Intermediate Grades; Learning Activities; *Marine Biology; *Marine Education; *Science Activities; Science Education; Science Instruction; Teaching Methods; Water; *Water Resources
IDENTIFIERS	*Chesapeake Bay; Maryland

ABSTRACT

The "Maryland: Mountains to the Sea" exhibit (National Aquarium in Baltimore) consists of four exhibits and eight graphics panels. The exhibits are an Allegheny pond and a salt marsh which are both partially open, Assateague beach which includes birds, and the continental shelf. A variety of Maryland pond and ocean fish, crabs, and water birds are displayed in the exhibits. The graphics panels include information on the water cycle, the Chesapeake Bay, the productivity of the marsh and the bay, and information on the continental shelf. This guide is designed to be used in conjunction with a trip to this exhibit. The trip fits well with units that include topics related to the ecology of a pond, marsh, or estuary, Maryland geology and geography, the Chesapeake Bay, food webs, and the water cycle. The guide include: (1) introductory information about the exhibits; (2) pre-visit activities suggestions; (3) post-visit activities suggestions (including a water cycle crossword puzzle, information on and procedures for constructing a simple model estuary, a geography exercise on the Chesapeake Bay, procedures for making a hydrometer, and other activities); (4) a list of suggested readings; and (5) a list of suggested films (keyed by location and age/educational level). (JN)

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MARYLAND: MOUNTAINS TO THE SEA

A GALLERY CLASS
GRADES 4–6

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MARYLAND: MOUNTAINS TO THE SEA

Maryland has many water habitats: streams and rivers, fresh and salt water marshes, the Chesapeake Bay and beaches, and the Atlantic Ocean. The Maryland: Mountains to the Sea gallery explores four of these habitats. This 45 minute program will begin in the small classroom with a review of the water cycle and the different habitats represented in the Maryland: Mountains to the Sea exhibit. During the classroom introduction students will be involved in several activities that will help them identify the animals and habitats they will examine in the galleries.

The Maryland: Mountains to the Sea exhibit consists of four exhibits and eight graphics panels. The exhibits are an Allegheny Pond and a Salt Marsh which are both partially open, Assateague Beach which includes birds, and the Continental Shelf. A variety of Maryland pond and ocean fish, crabs and water birds are displayed in the exhibits. The graphics panels include information on the water cycle, the Chesapeake Bay, the productivity of the marsh and the bay, and formation of the continental shelf.

The gallery is a small area so students will be divided into groups with a specific assignment before they visit the galleries. The students will circulate between the exhibit areas with an activities worksheet to complete. Activities include questions and observations about the water cycle, the salinity of the water, the makeup of the ground surface, and the kinds of animals in the exhibit. A staff person will be on hand to help with the activities, and review the results with the groups. Worksheets will be reviewed and collected at the end of the tour for further use in your classroom.

This tour will fit in well with units that include the ecology of a pond, marsh or estuary, Maryland geology and geography, the Chesapeake Bay, food webs and the water cycle.

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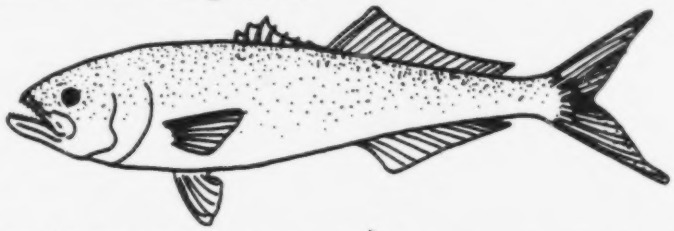
Don't miss the 7-minute audio-visual presentation in the Habitat Theatre on Level 3 entitled "The Chesapeake: A Bay at Risk."

PRE-VISIT ACTIVITIES SUGGESTIONS:

Have the class look at a map of Maryland and trace the flow of water. What is the highest part of the State? Where does the water come from? Where does it flow? Is it fresh, brackish (a combination of fresh and salt water), or salty? Where are the marshes in the State? Are they fresh water or salt water? This kind of information can be transferred to a large Maryland map. Use a Maryland highway map - the largest you can find - as a pattern to trace an outline of the state on a large piece of white paper. Include major rivers, mountains, and some of the major cities in the state. If you can find a topographical map, it will help you locate the mountains. Navigation charts will provide information on bay and ocean depths if you wish to include this information on your map. Develop a key for coloring various areas of the map. Mountains, fresh water marshes, streams and rivers, salt marshes, brackish Bay water and salt water can be included on your map. An invaluable aid to the mapping project is The Chesapeake Bay in Maryland: An Atlas of Natural Resources, by Alice Jane Lippson. It describes and locates marsh areas, plants and animals in and around the Chesapeake Bay in Maryland.

A shorter version of this activity is attached. It is a map of the Chesapeake Bay area and a worksheet covering states, cities, rivers, and some of the ways water is important to Maryland.



A Model Estuary is an activity which demonstrates how fresh and salt water mix in an estuary.

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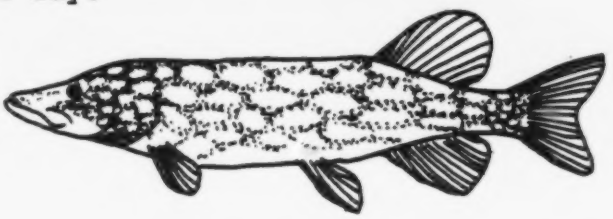
POST-VISIT ACTIVITIES SUGGESTIONS:

Use the worksheets the class completed at the Aquarium to intiate a discussion of Maryland habitats.

Go over the worksheets and compare the answers from one exhibit to the next. How does water move? Where is the water fresh and where does it become salty? How is the bottom surface different from one area to the next? What would cause these differences? Why do some animals live in some areas and not others? What different shapes were the fish? How do they move?

Have students write a story about one of the exhibits in the Mountains to the Sea gallery. They can focus on one animal in the exhibit. They can use the information they collected in the gallery to help them with their report. They can draw a picture of the animal. Where does the animal live, what are its prey and predators? How does it reproduce? Does it always stay in that habitat? Why would it move? Does it do best in fresh or saline water? What does its environment look like?

An activity that is enclosed is The Water Cycle Crossword Puzzle. This is a fill-in-the blanks on the water cycle. Depending on your class, you can provide the listing of words at the bottom of the page or leave it to them to figure out the appropriate words. It is a good review of the worksheets students completed at the exhibits. The Chesapeake Bay: The Biology for Elementary Teachers has an activity that would be an appropriate review of the Mountains to the Sea tour. CROSS SECTION OF THE BAY is a worksheet including a map of the bay and animal pictures to cut out and paste in the appropriate habitats around the Bay.



MARYLAND: MOUNTAINS TO THE SEA

Maryland: Mountains to the Sea - this gallery is on Level 2 of the Aquarium and contains four exhibits and eight graphics panels.

1. WATER ON THE MOVE - graphic panel
   Description and illustration of the water cycle.

2. ALLEGHENY POND - open freshwater pond exhibit
   Catfish, bullheads, bass, black crappie, sunfish, pumpkinseed.

3. SHALLOW WORLD - graphic panel
   How a pond is formed, succession, pond life.

4. CHESAPEAKE BAY - graphic panel
   Satellite photo of the Bay indicating vegetation, water, and urban areas.

5. TIDAL MARSH - open salt marsh exhibit
   Banded killifish, mummichog, blue crabs, sheepshead, minnow.

6. RICHES OF THE EARTH - graphic panel
   Marsh ecosystems and productivity.

7. BEACH DYNAMICS - graphic panel
   Beach grass, Assateague beach, wave action on the beach.

8. ASSATEAGUE BEACH - closed beach exhibit
   Killdeer, ghost crabs, moon shell, knobbed whelk, windowpane flounder, northern puffers.

9. BEACH LIFE - graphic panel
   Animals found on the beach including ponies and shore birds.

10. PASTURES OF THE SEA - graphic panel
    Zooplankton and phytoplankton

11. CONTINENTAL SHELF - closed open ocean tank
    Scup, black sea bass, flounder, lobster, sea trout or weakfish.

12. THE SHELF - graphic panel
    How continental shelves are formed and resources in the shelf area.

The Water Cycle
a crossword puzzle

Where does the water come from that fills Maryland's mountain streams and flows to the Atlantic Ocean? Water is constantly circulating in a sun-powered system in which water evaporates from the ocean and land and returns to the earth as (14) _____. A word you might hear on the evening weather report for rain or snow or sleet is (15) _____.

Some of the water that reaches the earth is immediately taken up by plants. Some of it turns to vapor and forms clouds. This is called (6) _____. Most water falls on the ground and finds its way to small (5) _____ which flow into (1) _____. The water that flows across the ground and into streams is called (8)_____. It often carries soil and decayed materials into the streams. Some water filters directly onto the ground. Water flowing under the earth is called (10)_____. The (4) down _____ is a measure of how close the water is to the surface of the ground.

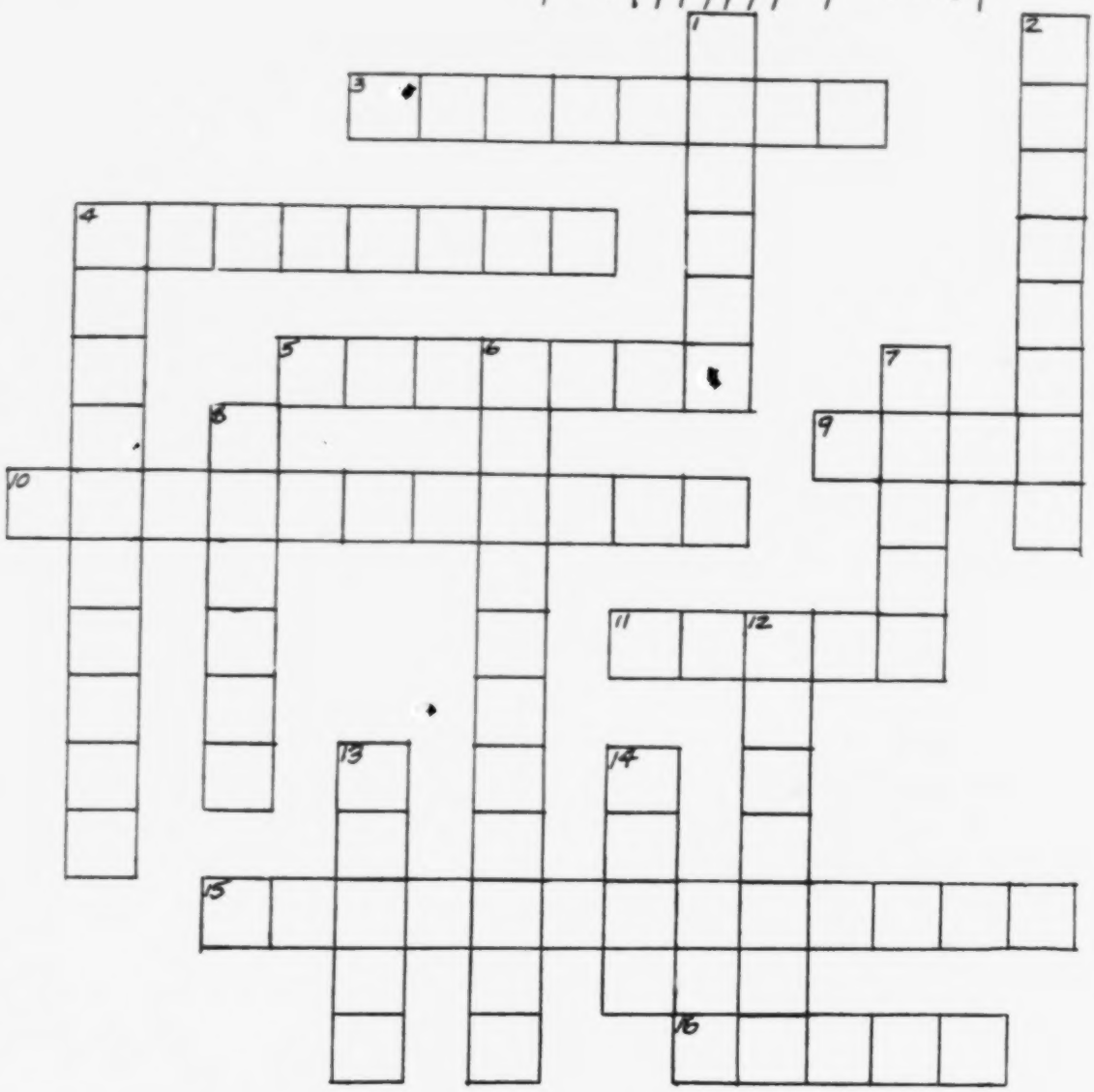
Water changes as it flows from streams and rivers to the (13) _____. You can taste the difference in the (2)_____ of the water. Water in mountain streams tastes (11) _____. Water from the ocean tastes like (9) _____. When the water table is at or near the surface of the ground (4) across _____ are formed. Some are fresh water and some are a combination of fresh and salt water called (3) _____water. A wetland area with brackish water is called a salt (7) _____. An area like the Chesapeake Bay where fresh water from rivers and salt water from the ocean mix is called an (12)_____.

Waters from the Chesapeake Bay eventually flow into the Atlantic Ocean. What happens to the water after it reaches the ocean? Heat from the sun causes it to evaporate and the water (16) _____ begins all over again.

WORDS USED IN THIS PUZZLE

brackish	fresh	rivers	water table
cycle	marsh	runoff	wetlands
estuary	ocean	salinity	
evaporation	precipitation	streams	
salt	rain	groundwater	

The Water Cycle



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The Water Cycle

ANSWER KEY

						1 R							2 S	
				3 B	R	A	C	K	I	S	H		A	
									V				L	
			4 W	E	T	L	A	N	D	S			I	
			A						E				N	
			T			5 S	T	R	E	A	M	S	I	
			E		8 R				V			9 S	A	L T
		10 G	R	O	U	N	D	W	A	T	E	R	R	Y
			T		N				P				S	
			A		O				O			11 F	R	12 E S H
			B		F				R				S	
			L		F		13 O		A		14 R		T	
			E				C		T		A		U	
					15 P	R	E	C	I	P	I	T	A	T I O N
							A		O		N		R	
							N		N			16 C	Y	C L E

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What Is an Estuary?

The Chesapeake Bay is an estuary. An ESTUARY can be defined as a semi-enclosed body of water which has free access to the ocean and whose water is diluted by fresh water from inflowing rivers. The Chesapeake Bay fits this definition well. It is separated from the Atlantic Ocean by Delaware and the Eastern Shore of both Maryland and Virginia (the Delmarva Peninsula), and is supplied with fresh water by dozens of rivers, among them Maryland's Susquehanna, Potomac, Patapsco and Virginia's Rappahannock and James. The Chesapeake Bay is the largest estuary in North America and one of the largest in the world. It is a unique and valuable resource for the State of Maryland and the United States.

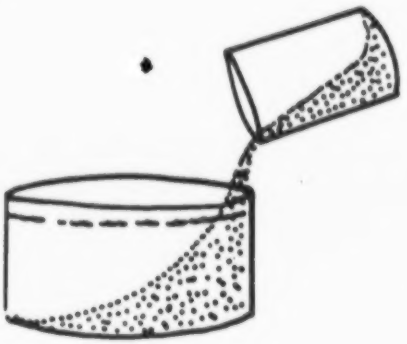
Salt water from the ocean flows up the Chesapeake Bay with the incoming tide. It is heavier than fresh water, and flows in along the bottom, under the layer of lighter fresh water flowing down the Bay. The total freshwater flow out of the mouth of the Bay is matched by 24 times that much salt water moving back with it. The waters of the Chesapeake are fresh at the mouth of the Susquehanna, with salinity gradually increasing to almost full strength sea water in the lower portion of the Bay.

A Model Estuary

This activity involves constructing a simple model of an estuary and might serve as a teacher demonstration.

MATERIALS NEEDED:

Large clear container
(gallon jar is ideal)
Liter (quart) container
for mixing salt water
Food coloring, 10 drops
Salt, 125 ml (½ cup)



DIRECTIONS:

1. Fill the large clear container three-fourths full of tap water. This represents a fresh body of water (river).
2. Mix the salt and tap water in the liter container. Add the food coloring. This represents a salty body of water (ocean).
3. Slowly pour the salt solution down the side of the large container. The salt water, being heavier, will sink and form a distinct layer on the bottom.
4. Refer back to the information "What Is An Estuary?". Why does the saltwater from the ocean, flowing up the Chesapeake Bay with the incoming tide, flow in along the bottom? _____

_____

_____

The Chesapeake Bay

1. Locate and label these places:

Chesapeake Bay	Chincoteague Bay
Atlantic Ocean	Potomac River
Baltimore City	Susquehanna River
Annapolis	Patapsco River
Ocean City	

2. Parts of 5 states are shown on your map. Locate and label them. Use the dotted lines (-.-.-.) to help you with state boundaries.

3. What state to the south of Maryland shares the Chesapeake Bay? _____

4. Find and label the Delaware Bay and Chincoteague Bay. List 2 ways that they are different from the Chesapeake Bay.

   A. _____

   B. _____

5. The Chesapeake Bay has many rivers flowing into it. Label 5 of the largest rivers. _____

   _____

   Which kind of water, fresh water or salt water, do rivers bring into the Bay? _____ _____

   Which kind of water, fresh water or salt water, does the ocean bring to the Bay? _____

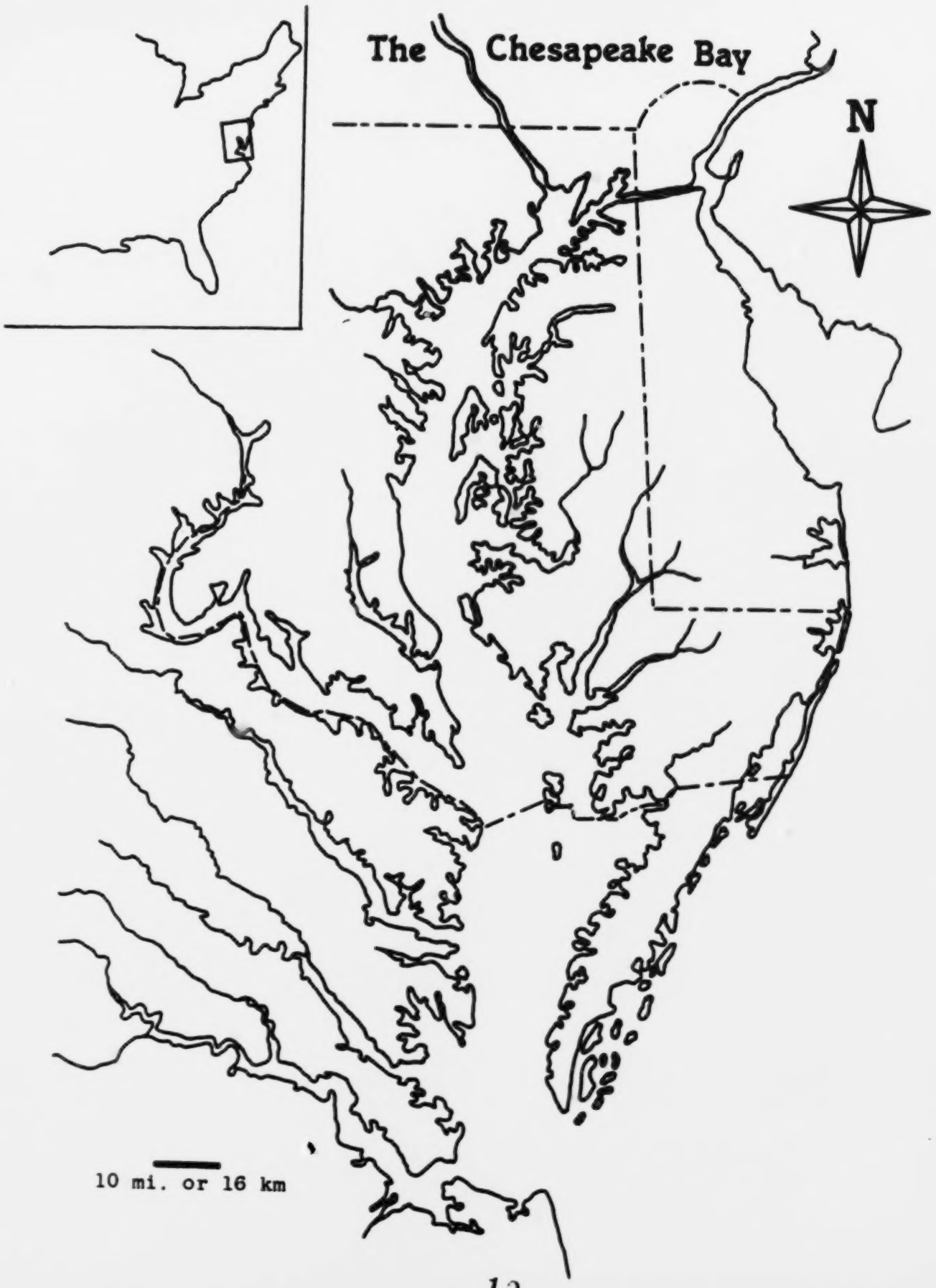
6. Water is used in many ways. List 6 ways that towns and industries use water.

   A. _____ D. _____

   B. _____ E. _____

   C. _____ F. _____

   Think about where the used water finally ends up. How can Maryland control water quality when so many states and towns and industries use water before it enters the Bay? _____


The Chesapeake Bay
N
10 mi. or 16 km

Making a Hydrometer

A hydrometer is a sealed glass tube which is weighted at the bottom and has a scale on the stem. It measures the density of sea water, thereby indicating the amount of solid material dissolved in water. In this activity you will make a smiple hydrometer and test the densities of different liquids.

MATERIALS NEEDED:

Plastic straws
Modeling clay
BB's, sand or small weights
Waterproof marker
Metric ruler
Clear jars or large glasses
Table salt
Stirrer
Variety of liquids: syrup, soda, cooking oil, vinegar, soup, etc.

DIRECTIONS:

1. Plug the end of a plastic straw with clay.
2. Add enough BB's, sand or small weights for the straw to float upright in a container of water.
3. With a waterproof marker, mark the straw in half-centimeter units, showing the water level as 1. This will be the reference point for tap water.
4. Mix several salt solutions by dissolving different amounts of salt in several jars of water. Label jars according to the amount of salt dissolved. Float a hydrometer in each solution.

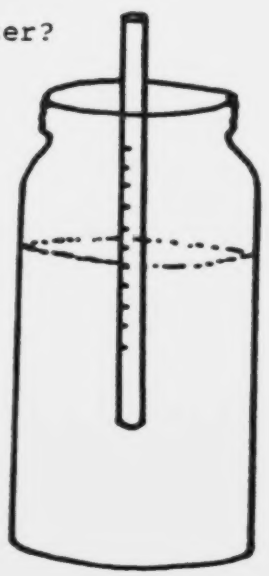
   It floats higher in which one?
5. Leave the hydrometer in a salt solution for several days. As the water evaporates, does the hydrometer float higher or lower?

   What does this tell you about the salinity?
6. Compare warm water with very cold water. The hydrometer floats higher in which one?

   Which is more dense, warm water or cold water?
7. Test the densities of other liquids. Float a hydrometer in jars or glasses of syrup, cooking oil, vinegar, soup, alcohol, mineral oil, soda, etc.

   How do they compare with the reading for tap water?
8. Look up hydrometer in a good dictionary. What does "hydro" mean?

   How does this make sense with what a hydrometer does?



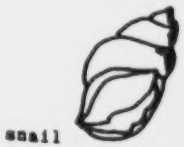
Cross Section of the Bay

Examine the animals below. Where would they most likely live: the marsh, on the bottom, or open water? Cut out the pictures and place them in the most reasonable locations on the activity sheet, "Cross Section of the Bay." Look up any animal which is unfamiliar to you. When satisfied, glue your pictures to the sheet.

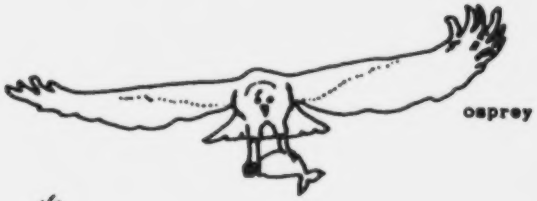
fish

raccoon

plankton


snail

jellyfish


osprey

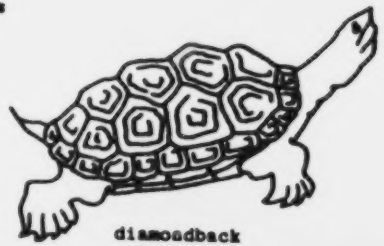
oysters

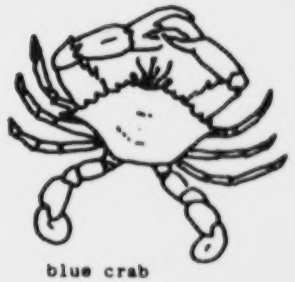
heron

barnacles

insect

plankton


diamondback terrapin


blue crab

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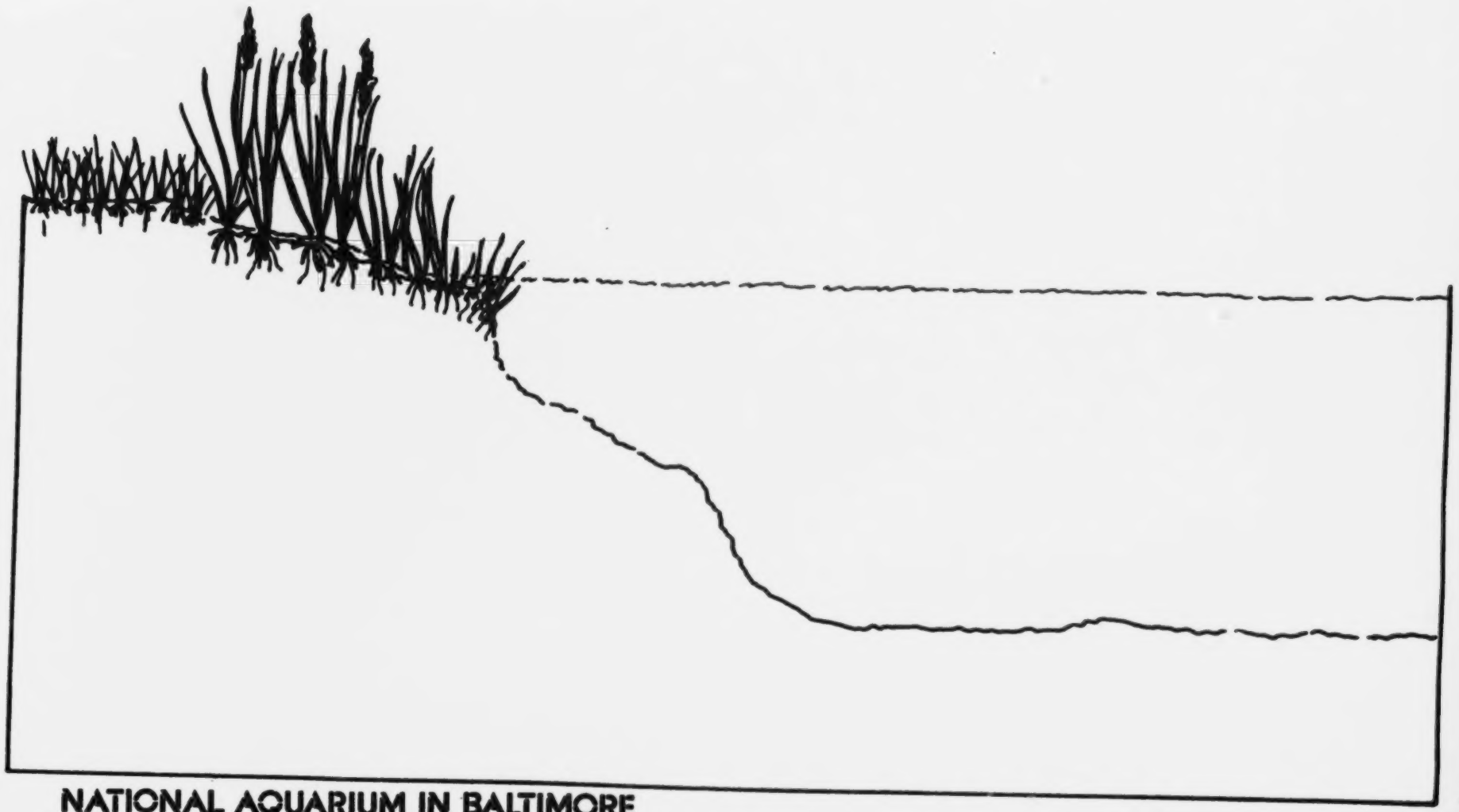
Cross Section of the Bay



The Chesapeake Bay

ANSWER KEY

2. Pennsylvania, New Jersey, Delaware, Maryland, Virginia
3. Virginia
4. Size, number of tributaries leading into bays
5. Among the largest: Susquehanna, Gunpowder, Patapsco, Patuxent, Potomic, Choptank, Chester
6. Among suggested answers: as a coolant for equipment, drinking, cooking, swimming pools, steam for boilers, cleaning, and for products containing water. Multilateral commissions and consistent legislation.

Making a Hydrometer

ANSWER KEY

4. A hydrometer floats higher in the saltiest solution.
5. Higher; the salinity increases as the water evaporates.
6. It floats higher in cold water, which is denser than warm water.
8. Hydro-water, meter-measure.

Cross Section of the Bay

ANSWER KEY

Suggested answers:

MARSH: raccoon, insect, heron, snail (on marsh grass), barnacles (on hard surfaces)

ON THE BOTTOM: barnacles, oysters, snail, blue crab

OPEN WATER: fish, plankton, jellyfish, terrapin, osprey (above the open water)

MARYLAND: MOUNTAINS TO THE SEA SUGGESTED READING

The Chesapeake Bay in Maryland: An Atlas of Natural Resources, Alice Jane Lippson, the Johns Hopkins University Press 1973.

Estuaries: Where Rivers Meet the Sea, Laurence Pringle, MacMillan Publishing Co., 1973.

Arms of the Sea: Our Vital Estuaries, Elizabeth Shepherd, Lothrop, Lee and Shephard 1973.

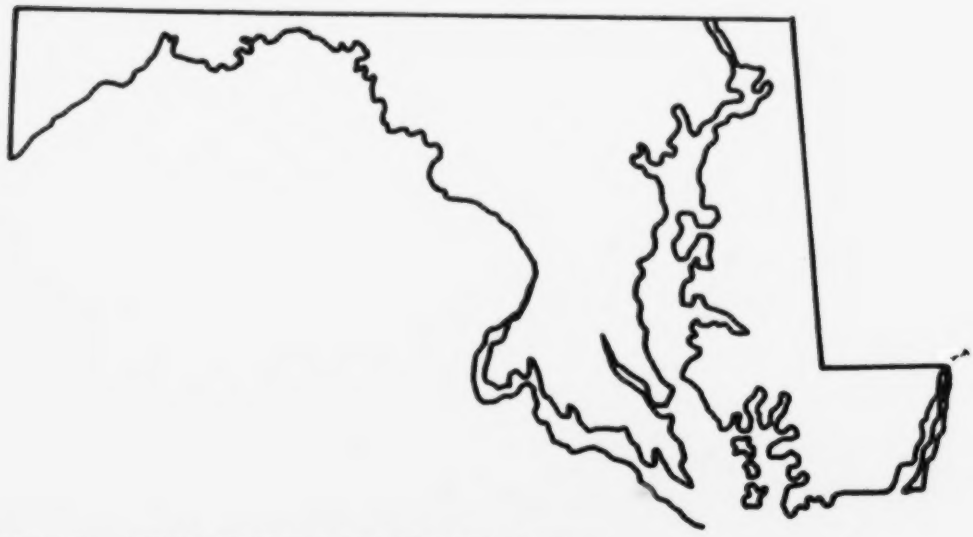
Food Webs in an Estuary, University of Maryland Sea Grant Program, Marine Science Education Project, Publication Number UM-SG-E-7902.

Beautiful Swimmers, William W. Warner, Penguin Books, 1977.

Pond Life, George K. Reid, Ph.D., Golden Press.

The Chesapeake Bay: An Introduction for Elementary Teachers. and

The Chesapeake Bay: The Biology for Elementary Teachers, Katherine Reppa, Valerie Chase, Ph.D., The National Aquarium in Baltimore



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Suggested Films

MARYLAND: MOUNTAINS TO THE SEA

Numerous films are available in our area that can be used in conjunction with this program. Each is listed below, not only by library system, but also by the age level it is intended for.

KEY

Age Level:

P	Primary
I	Intermediate
J	Jr. High
H	High
C	College
G	General

Library System:

C	Baltimore City
CO	Baltimore County
EP	Enoch-Pratt

Between the Tides	(EP)	I,J,H,C
Animal Communities	(C)	I,J
Birds of the Inland Waterways	(C)	P,I,J
Birds of the Sea	(C)	P,I,J
Life Between the Tides	(C)	J,H
Marsh Community	(C)	I,J,H
Birds of the Sandy Beach	(C)	P,I,J
Fish: A First Inquiry	(C)	P,I
Animal Life at Low Tide	(C)	
Beach and Sea Animals	(C)	I,J
Life in the Sea	(EP)	I,J
Science of the Sea	(C)	J,H,C
Chesapeake Blues	(CO)	
Salt Marshes: Barrier Between the Land and Sea	(CO)	H,C,G
Food Chain in the Ocean	(CO)	I,J

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